**IEEE 802.15**

**Wireless Specialty Networks**

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| Project | IEEE 802.15 Working Group for Wireless Specialty Networks |
| Title | 15.6a functional technical requirements for PHY proposals |
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| Response | To call for contributions |
| Abstract | This document contains a summary of the technical requirements for proposals to form the P802.15.6 revision specification. |
| Purpose | For discussion in the join session 15.6a, 15.4ab, 15.14 |
| Notice | This document has been prepared to assist the IEEE P802.15.6a. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein. |

1. System Performance
   1. Throughput measured at MAC SAP

The 802.15.6a amendment (revision) shall provide at least one mode of operation capable of achieving a throughput of at least 40 Mb/s, operating at a maximum mandatory data rate of 50 Mb/s\* in the high band of UWB (500 MHz channel) under a Packet Delivery Ratio of 99%.

\*The new data rates proposed in 15.4ab of 62.4 Mb/s and 124.8 Mb/s look promising. We need to check reliability in congested environments and transmission ranges.

* 1. Transmission range

The 802.15.6a amendment (revision) shall provide at least one mode of operation that achieves the same transmission range as the one provided by IEEE Std 802.15.6-2012 of 3m at the highest possible data rate operating in the high band of UWB band.

* 1. Transmission reliability

The 802.15.6a amendment (revision) shall improve transmission reliability under congested communication environments compared to IEEE Std 802.15.6-2012 operating in the UWB band, including interference from other 15.6 BANs (intra-interference) and other wireless systems (inter-interference) operating in the UWB band.

A 15.6a device may be equipped with multiple antennas configuration to support a higher data rate mode.

* 1. Latency

The 802.15.6a amendment shall improve latency under congested communication environments compared to IEEE Std 802.15.6-2012 operating in the UWB band.

Proposals should include end-to-end latency in the interval [250 msec, 1 sec]. Association latency bounded to 1 sec.

Proposals for critical use cases should include end-to-end latency bounded to 100 msec.

* 1. Ranging

A data rate of 500 kb/s is aimed to be compatible with the 15.4ab proposal.

1. PHY layer

The PHY layer includes, but not be limited to, mechanisms for synchronization, channel estimation, modulation, FEC, ranging, Clear Channel Assessment (CCA), and interference mitigation that satisfy the performance requirements mentioned above (clause 1).

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| **PHY** | **15.6 requirement** | **15.4** | **Comments** |
| 15.4ab PHY | Throughput of at least 40 Mb/s, operating at a maximum data rate of 50 Mb/s\* (500 MHz channel) under a Packet Delivery Ratio of 99% measured at the MAC-SAP. |  | \*The new data rates proposed in 15.4ab of 62.4 Mb/s and 124.8 Mb/s look promising. |
| 15.4ab PHY | Transmission range of at least 3m. |  |  |
| 15.4ab PHY | Transmission reliability under congested communication environments including interference from other 15.6 BANs (intra-interference) and other wireless systems (inter-interference): PDR measured at the MAC-SAP. |  |  |
| 15.4ab PHY | End-to-end latency in the interval [250 msec, 1 sec].  Critical use cases include end-to-end latency bounded to 100 msec. |  | Under study 4 msec for critical use cases. |
| 15.4ab PHY | Ranging with a data rate of 500 kb/s. |  |  |

Throughput denotes the effective transfer of information data rate (without overhead) in b/s measured at the MAC-SAP during a communication flow. It involves losses in the radio link due to congestion, transmission range, interference, and protocol communication exchanges.

Transmission range: the minimum required distance between two wireless devices that form a single wireless link, with the condition that all requirement metrics in the above table are met.

End-to-end latency: the maximum allowable time it takes for the transmitter to send a MAC frame from the transmitter’s MAC-SAP to the receiver’s MAC-SAP.

Transmission reliability: PDR measured at the MAC-SAP within the latency requirement.

* 1. Join session observations

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| **PHY Spec. Parameter** | **15.6a requirement** | **15.4 (z and ab) capability** | **Comments** |
| **Throughput & Data Rate** | Throughput of at least 40 Mb/s, operating at a maximum data rate of 50 Mb/s\* (500 MHz channel) under a Packet Success Ratio of 99% measured at the MAC-SAP. | The new data rates proposed in 15.4ab of 62.4 Mb/s and 124.8 Mb/s look promising | Maybe Covered w/802.15.4 UWB |
| **Range** | Transmission range of at least 3m for backwards compatibility (from use cases doc.). | Up to 100m | Covered w/802.15.4 UWB |
| **Reliability & Interference Immunity** | Transmission reliability under congested communication environments including interference from other 15.6 BANs (intra-interference) and other wireless systems (inter-interference): PDR measured at the MAC-SAP. | Many capabilities either existing or being developed | Needs further discussion w.r.t. particular .6a needs |
| **Latency** | End-to-end latency in the interval   250 msec for x QOS  1 sec for y QOS QOS def. is being worked on  Critical use cases include end-to-end latency bounded to 100 msec. | Low latency is one of the areas being worked on in .4ab | 4 msec for critical .6a use cases is under study . |
| **Ranging Data Rate** | Ranging with a data rate of 500 kb/s. | Supported with sub-centimeter accuracy |  |

1. TG6a Timeline

TG formation amendment: September 2021

TG revision: July 2022

**Use cases & Technical Requirements & Channel model document:** July 2022

**Call for proposals:** September 2022

**Specification Framework Document:** November 2022

**Draft Specification:** January 2023

**802.15 Working Group Letter ballot:** March 2023

**IEEE Standards Association Sponsor ballot:** July 2023

**RevComm approval:** December 2023